

**REMARKS**

**I. INTRODUCTORY REMARKS**

The Applicants (hereinafter Applicant) thank the Examiner for the careful consideration of this application. The Office Action dated December 16, 2008 has been received and its contents carefully considered. Applicant incorporates the substance of claim 2 into claim 1. Accordingly, Applicant cancels claim 2. Claims 1 and 3-16 are currently pending in this application.

Applicant submits that because amended claim 1 merely places claim 2 in independent form, that no new issues arise from this amendment and that no further search is required for consideration of this amendment. Entry of this amendment is therefore requested without the need to file a Request for Continued Examination.

Based on the foregoing amendments and the following remarks, Applicant respectfully requests that the Examiner reconsider all outstanding rejections and that they be withdrawn.

**II. PETITION UNDER 37 CFR 1.84(A)(2)**

In response to the Action dated March 4, 2009, Applicant thanks the Examiner for the granting of the color drawing petition. Applicant herewith amends the specification to include the necessary notice of the color drawings.

**III. CLAIM REJECTIONS UNDER 35 U.S.C. § 103(A)**

On page 2, the Office Action addresses the requirements for joint inventorship.

Applicant reasserts that the subject matter of the various claims was commonly owned at the time any inventions covered therein.

On page 3 of the Office Action, claims 1, 3, 5, and 7-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,122,240 to Banas in view of U.S. Patent No. 4,968,383 to Volkmann et al in view of U.S. Patent No. 4,229,232 to Kirkpatrick. On pages 3-4, claims 2, 4, 6, and 13 are rejected as obvious over Banas in view of Volkmann in view of Kirkpatrick and further in view of U.S. Patent No. 5,232,674 to Mukai et al. In view of the incorporation of claim 2 into claim 1, Applicant considers the rejection to claim 2 as applied to claim 1, as amended. Nevertheless, Applicant respectfully submits that any combination of Banas, Volkmann, Kirkpatrick, and Mukai fail to disclose or render obvious the features of claim 1 as now amended.

Initially, it is noted that the Action implicitly acknowledges that the combination of Banas, Volkmann and Kirkpatrick is insufficient as applied to claim 2 (now amended claim 1). The Action therefore adds the fourth reference to Mukai in the rejection of claim 2. However, as discussed below, even the addition of Mukai fails to meet all the limitations of amended claim 1.

**A. BANAS**

Applicant amends claim 1 to recite, “A method for smoothing and polishing a to-be-smoothed surfaces, comprising: **a first treatment step....and a second treatment step** comprising leveling micro-roughness remaining ...by remelting ... and by evaporating roughness peaks.”

Banas fails to at least disclose and render obvious, “a second treatment step comprising leveling micro-roughness remaining ...**by evaporating roughness peaks**,” as recited by amended claim 1 (Emphasis added). Banas describes a surface treatment for a class of metallic articles involving the **melting** of a thin surface layer of the article by a concentrated energy source (See Banas Abstract). Banas further describes a rapid solidification following the melting which produces unique metallurgical structures (See Banas, col. 1, lines 12- 13). Banas provides that “the present invention involves surface **melting but no surface vaporization**” and further provides “energy input parameters are controlled so as to **avoid surface vaporization**” (Emphasis added, see col. 2, lines 1-2 and lines 38-40). Accordingly, Applicant respectfully submits that Banas teaches away from the claimed invention. Banas fails to disclose “A method for smoothing and polishing a to-be-smoothed surfaces, comprising: a first treatment step....and a second treatment step comprising... evaporating roughness peaks ,” as recited by amended claim 1.

#### **B. VOLKMANN**

On pages 2 and 3, the Action turns to Volkman for describing “use of a laser beam for melting and resolidifying a surface with projections less than 20 micrometers” and for describing using a selected gas. However, the disclosure of Volkman is directed to an entirely different process which is a method for **adhesively bonding** a first body to a second body (See Volkman Abstract). Accordingly, it is not seen why one of ordinary skill in the art would consult Volkman for teachings relating to polishing and smoothing surfaces. Moreover, Volkman does not disclose “a second treatment step comprising leveling micro-roughness remaining on said surface after said first treatment step by remelting the micro-roughness using said energetic radiation while employing second

treatment parameters down to a second remelting depth, and by evaporating roughness peaks, wherein the second remelting depth is less than said first remelting depth,” as recited in amended claim 1.

### C. KIRKPATRICK

On page 3, the Action next turns to Kirkpatrick to remedy the deficiencies of Banas and Volkmann. Kirkpatrick discloses a pulsed beam generator that produces a short duration pulsed beam for **thermal processing** of selected regions of metallic and dielectric materials (See Kirkpatrick Abstract). According to Kirkpatrick, the energy density of the pulsed laser is made sufficiently high to elevate the temperature without causing deleterious effects such as vaporization, fracturing and the like (column 3, lines 38-40). Therefore Kirkpatrick also fails to teach a “method for smoothing and polishing a to-be-smoothed surfaces, comprising: a first treatment step....and a second treatment step” as recited by amended claim 1. Kirkpatrick provides for “melting a thin surface layer” but does not provide for a second treatment step involving “evaporating” as claimed (See col. 6, line 9-10).

Furthermore, Applicant again respectfully disagrees with the conclusory statement at page 3 of the Office Action whereby it is suggested that the “claimed pulse duration times and remelting depths would have been obvious at the time applicant’s invention was made....because particular materials require different particular process parameters and because developments in the laser art has provided a greater range of parameters useful for surface treatments.” This generalization is unfounded and has no relevance to the “particular” surface treatment claimed in the present application. Namely, Applicant is claiming a **method for smoothing and polishing a surface** which

involves remelting and evaporating as claimed. Kirkpatrick, on the other hand, does not even recognize the problem that the Applicants solve and Kirkpatrick does not address a need in the art for the Applicant's invention. The Applicant demonstrates that there is a need in the art for a method for smoothing and polishing surfaces that "does not require expensive measuring instruments and can be used to automatically polish any three-dimensional surface, in particular metal surfaces, quickly and inexpensively" (See Specification page 3, paragraph 2). Kirkpatrick does not address any of the issues that the Applicant addresses.

The Applicant respectfully submits that the claimed invention is not rendered obvious to a person having ordinary skill in the art in light of Kirkpatrick. A person of ordinary skill in the art would have no reason to consider the teachings of Kirkpatrick and a person of ordinary skill in the art would not have been able to predict the results of the claimed invention.

#### D. MUKAI

Lastly, on page 4, the Action turns to Mukai to remedy the deficiencies of the other cited references. However, Mukai also fails to disclose "a second treatment step comprising leveling micro-roughness remaining on said surface ... by remelting the micro-roughness using said energetic radiation ...and by **evaporating** roughness peaks" as recited in amended claim 1 (Emphasis Added).

In contrast, Mukai discloses a method for improving the surface morphology of laser irradiated surfaces and in particular by irradiating the surface of an interconnection material on a semiconductor device. Mukai's method aims at eliminating problems connected with deterioration generated in the surface of an interconnection layer leading

to a disconnection of the interconnected materials **"and avoiding an undesirable post heating effect and accordingly prevent the conductor material from evaporating after a number of pulse laser irradiations"** (Column 2, lines 27-42). Mukai teaches a first method step of irradiating a pulse laser beam on a region of a conductor material formed on an under layer to melt the entire conductor layer. However, upon solidification, the entire conductor layer is not smooth according to Mukai because the conductor layer contracts in the periphery of nucleation sites 4, and depressions 5 are formed at the surface of the conductor layer as shown, for example, in Figure 2A, thereby deteriorating the surface morphology. Mukai teaches a second method step of irradiating a pulse laser beam on the irradiated region of the conductor layer such that only a surface portion of the conductor layer **melts** in a substantially entire irradiated region. The second step irradiates the pulse laser at a second energy level which is lower than the energy level of the irradiation in the first step. The second laser irradiation melts only a surface portion of the conductor layers such that the melt flows into the depressions 5 to improve the surface morphology. However, as noted above, Mukai does **not** teach employing treatment parameters in the second irradiation step that not only remelts down to a second remelting depth, but also evaporates roughness peaks, as required by the treatment parameters of the second treatment according to claim 1.

In view of the above, it is submitted that no reasonable combination of Banas, Volkmann, Kirkpatrick, and Mukai could possibly result in the invention recited by amended claim 1, because none of these references teach the first and second treatment steps as now recited in amended claim 1. Therefore, Applicant respectfully requests reconsideration and withdrawal of the rejection applied against claim 2, now amended claim 1.

Claims 3-16 variously depend from independent claim 1. Applicant respectfully submits that claims 3-16 are patentable over the cited references for at least the same reasons as claim 1. The additional cited references fail to remedy the deficiencies of the discussed references above. Applicant respectfully request reconsideration and withdrawal of the rejections.

#### IV. CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicant, therefore, respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested

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